

## A Low-Cost, High-Precision Navigator, Phase II

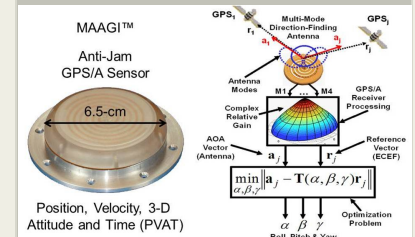
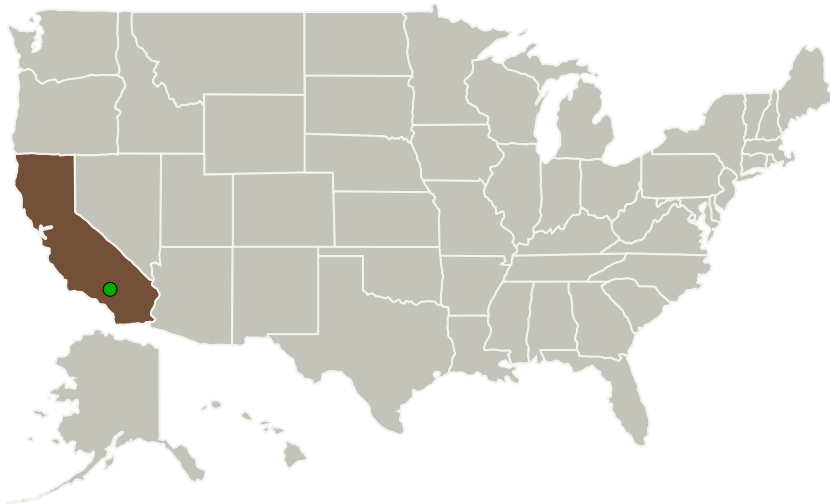
Completed Technology Project (2012 - 2014)



## Project Introduction

Toyon Research Corporation proposes to develop and demonstrate a prototype low-cost precision navigation system using commercial-grade gyroscopes and accelerometers. During the Phase I effort an uncalibrated brassboard system was built and flight tested using a manned biplane. The brassboard system comprised an experimental single-channel (L1-only) software GPS receiver, and a 720 deg/hr inertial measurement unit (IMU) costing only \$1k. The performance of the brassboard system was comparable to that of a \$42k precision reference system that comprised a dual-channel (L1 and L2) GPS receiver and antenna, and a tactical-grade (1 deg/hr) IMU (\$24k). This tactical-grade performance was achieved by fusing low-cost inertial measurements with attitude and position measurements from a GPS-based attitude (GPS/A) sensor. The Miniature Integrated Direction-finding Attitude-determining Anti-jam System (MIDAAS(TM)) obtains position, velocity, attitude, and time (PVAT) measurements directly from GPS signals and employs an innovative small single-aperture antenna to compute full 3-D attitude (roll, pitch and yaw) using only two RF channels, leading to a smaller, simpler, lower-cost GPS/A receiver system. During the Phase II program, a form-fit-function prototype system will be designed, built, and flight tested in an operational environment. The prototype performance will be compared with that of a higher-accuracy, more expensive attitude reference system.

## Primary U.S. Work Locations and Key Partners



A Low-Cost, High-Precision Navigator

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Organizations Performing Work	Role	Type	Location
Toyon Research Corporation	Lead Organization	Industry	Goleta, California
● Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

## Primary U.S. Work Locations

California

## Project Transitions

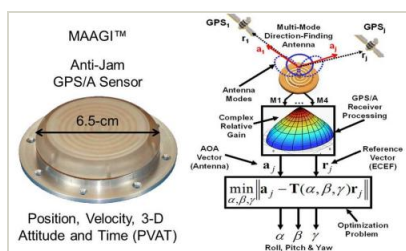
▶ **June 2012:** Project Start

✓ **December 2014:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137372>)

## Images



## Project Image

A Low-Cost, High-Precision Navigator

(<https://techport.nasa.gov/image/134869>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

Toyon Research Corporation

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

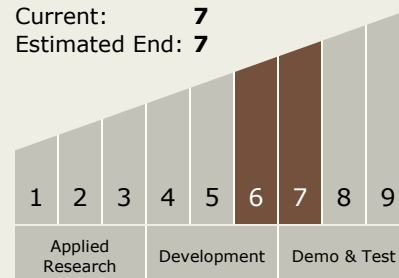
Carlos Torrez

## Principal Investigator:

Eric Sandoz

## Technology Maturity (TRL)

Start: 6  
Current: 7  
Estimated End: 7



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### Technology Areas

#### Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - └ TX17.4 Attitude Estimation Technologies
    - └ TX17.4.3 Attitude Estimation Sensors

### Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System